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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/360,292	07/22/1999	SUJIT SHARAN	MI22-1106	3962

21567 7590 12/20/2002

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EXAMINER

AHMED, SHAMIM

ART UNIT	PAPER NUMBER
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1765

15

DATE MAILED: 12/20/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

mk-15

Office Action Summary

Application No. 09/360,292		Applicant(s) SHARAN ET AL.	
Examiner Shamim Ahmed		Art Unit 1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 October 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 15-24 and 35-41 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 15-24 and 35-41 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 22 July 1999 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

Continued Prosecution Application

1. The request filed on 10/08/02 for a Continued Prosecution Application (CPA) under 37 CFR 1.53(d) based on parent Application No. 09/360,292 is acceptable and a CPA has been established. An action on the CPA follows.

Response to Arguments

2. Applicant's arguments with respect to claims 15-24 and 35-41 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 15-20, 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sharan et al (5,747,116) in view of Smith (6,277,733).

Sharan et al disclose a method of forming a contact to a silicon substrate, wherein a contact opening is formed over the silicon substrate and the opening is extending to expose outwardly a silicon containing material (col.3, lines 52-61 and figure 1).

Sharan et al also disclose that during the above process before depositing any material over the substrate, plasma cleaning is performed to remove unwanted material using hydrogen-containing plasma (col.3, lines 62-67).

Sharan et al do not explicitly teach that the contact opening is formed by applying a masking layer over the substrate.

However, in a method of making contact opening, Smith teaches that a contact hole or opening is formed by patterning a masking layer of photoresist (col.3, lines 36-45).

It would have been obvious to one skilled in the art at the time of claimed invention to mask the insulation layer (16) of Sharan et al with desired pattern in order to form an opening at a desired position as taught by Smith.

Sharan et al also do not teach that the plasma etching is performed at a temperature of at least 400 degree C.

However, Smith teaches that the temperature of the substrate is maintained around 100-400 degree C during the clean-up process (col.4, lines 32-40).

Therefore, it would have been obvious to one skill I the art at the time of claimed invention to combine Smith's teaching into Sharan et al's method for effective removal of the etching residues from the surface of the contact region as taught by Smith.

As to claim 16, Smith teaches the plasma can be an oxygen ash step followed by a clean-up step (col.3, lines 36-38).

As to claims 17-18 and 20, Sharan et al teach that the plasma comprises hydrogen (col.3, lines 64-67).

As to claim 19, Sharan et al teach that the plasma could comprise NH_3 (col.5, lines 25-28).

6. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sharan (5,747,116) in view of Smith (6,277,733) as applied to claims 15-20 and 22 above, and further in view of Brown et al (5,780,359).

Modified Sharan et al discussed above in the paragraph 5 but fail to teach the temperature is at least 600 degree C.

However, in a method of removing polymer residue from the surface and sidewalls of a silicon wafer, Brown et al teach that the temperature of the stripping process can be varied from 20 degrees to over 100 degrees C, while the benefits of using higher temperatures includes a rate increase in the chemical portion of the stripping process (col.4, lines 26-33).

Therefore, it would have been obvious to one skill I the art at the time of claimed invention to optimize the process temperature to an elevated one because the elevated

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temperature will increase the rate of reaction of the stripping process as taught by Brown et al.

7. Claims 23-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sharan et al (5,747,116) in view of Smith (6,277,733) as applied to claims 15-20 and 22 above, and further in view of Stinnett (6,325,861).

Modified Sharan et al discussed above in the paragraph 5 but fail to teach the introduction of at least two plasma etching using different gas chemistries.

However, Stinnett discloses a method for etching and plasma cleaning of a substrate twice in order to remove unwanted remnant residue from the substrate (col.8, lines 31-40).

Therefore, it would have been obvious to one skilled in the art at the time of claimed invention to combine Stinnett's teaching into modified Sharan et al's method for efficiently removing the remnant resist material to expose the substrate surface as taught by Stinnett.

By doing so, one could have a better process, wherein the etchant residue and the remnant resist is removed without using a wet cleaning process as taught by Stinnett (col.8, lines 46-49).

8. Claims 35, 38-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sharan et al (5,747,116) in view of Stinnett (6,325,861).

Sharan et al discussed above in the paragraph 5 but fail to disclose the etch residue is carbon containing layer.

However, in a method of making a contact opening through an insulation layer such as silicon dioxide, Stinnett teaches the etch residue includes carbon containing polymer (col.5, lines 13-25).

Therefore, it would have been obvious to have the etch residue is carbon containing polymer because the insulation layer of Sharan et al and the insulation layer of Stinnett are exactly similar and expected to have the same kind of etch residue upon etching the insulation layer to form an opening as taught by Stinnett.

As to claim 38, Stinnett teaches that the plasma gas comprises oxygen (col.7, lines 52-56).

As to claims 39-40, Sharan et al teach that the plasma comprises hydrogen (col.3, lines 64-67).

As to claim 41, Sharan et al teach that the plasma could comprise NH_3 (col.5, lines 25-28).

9. Claims 36-37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sharan et al (5,747,116) in view of Stinnett (6,325,861) as applied to claims 35, 38-41 above, and further in view of Brown et al (5,780,359).

Modified Sharan et al discussed above in the paragraph 4 but fail to teach the temperature is at least 400 degree and at least 600 degree C.

However, in a method of removing polymer residue from the surface and sidewalls of a silicon wafer, Brown et al teach that the temperature of the stripping process can be varied from 20 degrees to over 100 degrees C, while the benefits of

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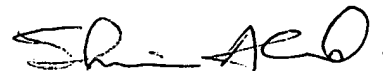
using higher temperatures includes a rate increase in the chemical portion of the stripping process (col.4, lines 26-33).

Therefore, it would have been obvious to one skill I the art at the time of claimed invention to optimize the process temperature to an elevated one because the elevated temperature will increase the rate of reaction of the stripping process as taught by Brown et al.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shamim Ahmed whose telephone number is (703) 305-1929. The examiner can normally be reached on M-Thu (7:00-5:30) Every Friday Off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on (703) 308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are (703)-872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.



Shamim Ahmed
Examiner
Art Unit 1765

SA
December 18, 2002